Remarks/Arguments:

Claims 1-5 have been amended. Claims 9 and 10 have been added. No new matter has been introduced herein. Claims 1-10 are pending.

Claims 1 and 5 have been amended to recite that a load conductor of an unbalanced antenna intersects a straight line which also passes through a first feeding point and which is perpendicular to a ground board. Basis for the amendments to claims 1 and 5 can be found, for example, in Fig. 1 of the subject specification. In addition, claims 2-4 have been amended to depend from claim 1.

Claims 1-8 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Rutfors et al. (U.S. 2003/0189519) in view of Colburn et al. (U.S. 2005/0162321). It is respectfully submitted, however, that these claims are patentable over the cited art for the reasons set forth below.

Claim 1, as amended, includes features neither disclosed nor suggested by the cited art, namely:

... an unbalanced antenna including ...

> a load conductor connected with the second end of the first radiator, the load conductor intersects a straight line which also passes through the first feeding point and which is perpendicular to the ground board, the load conductor has a shape symmetrical about the straight line; ...

.. a balanced antenna including ...

> a second radiator ... a third radiator ...
>
> the second radiator and the third radiator are placed at positions symmetrical to each other about the straight line, respectively, and have shapes symmetrical to each other about the straight line ... (Emphasis Added).

Rutfors et al. disclose, in Fig. 2, an unbalanced Planar Inverted F Antenna (PIFA) 20 and a balanced dipole antenna 230 that surrounds PIFA antenna 20 (paragraphs [0023], [0034] and [0037]). The PIFA antenna includes radiating element 20 that is spaced apart from and parallel to PCB 10 and includes a feeding portion 22. Feeding portion 22 is

connected to a feed element of transmitter portion 24. In addition, a grounding portion 23 is connected to a ground element of the transmitter portion. (See paragraph [0023]).

As acknowledged by the Examiner, Rutfors et al. do not disclose or suggest that a load conductor of an unbalanced antenna has a shape symmetrical about a straight line perpendicular to a ground board, as recited in claim 1. In addition, Rutfors et al. do not disclose or suggest Applicant's claimed features of a load conductor (of an unbalanced antenna) that "intersects a straight line which also passes through the first feeding point," (emphasis added), as required by claim 1.

Furthermore, Rutfors et al. do not disclose or suggest that second and third radiators (of a balanced antenna) are placed at positions symmetrical to each other about the straight line that passes through the first feed point (emphasis added), as required by claim 1. As acknowledged by the Examiner, at paragraph 6, pp. 6-7 of the Office Action, the first and second feed points of Rutfors et al. are in different locations (i.e., the feed points are not collinear). Accordingly, the radiators of dipole antenna 230 are not symmetric about a straight line passing through feeding portion 22. Thus, Rutfors et al. do not include all of the features of claim 1.

Colburn et al. disclose, in Fig. 1, antenna 10 including E-shaped metal plate 12 located at a distance from ground plane 14. Shorting tab 22 and feed tab 20 are centered on metal plate 12 and connected between metal plate 12 and ground plane 14 (paragraphs [0025] and [0027]). Antenna 10 is a combination of an inductively loaded center fed patch antenna and a PIFA ([0026]).

Colburn et al. do not disclose or suggest that: 1) a load conductor (of an unbalanced antenna) intersects a straight line which passes through the first feeding point and has a shape symmetrical about the straight line and 2) second and third radiators (of a balanced antenna) are placed at positions symmetrical to each other about the straight line (emphasis added), as required by claim 1. These features are neither disclosed nor suggested by Colburn et al. Colburn et al. do not teach both an unbalanced antenna and a balanced antenna and, thus, cannot disclose or suggest placing second and third radiators (of a balanced antenna) at positions symmetrical to each other about a straight line passing through a feeding point of an unbalanced antenna.

At paragraph 6, pages 6-7 of the Office Action, the Examiner asserts that "the invention of Rutfors does not teach away from changing the position of the feed point." The Examiner argues that feed element 24 of Rutfors can be positioned collinear with feed element 34, in order to substitute symmetrical metal plate 12 of Colburn for PIFA antenna 20 of Rutfors et al. (based on paragraph [0043] of Rutfors et al.). Applicant respectfully disagrees. In paragraph [0043], Rutfors et al. disclose that the unbalanced antenna can be a "patch, modified PIFA, meander PIFA, or a slot." Rutfors et al., however, do not disclose or suggest changing a position of feeding element 24.

As known to the skilled person, in order to combine the symmetrical PIFA antenna of Colburn with the unbalanced/balanced antenna device shown in Fig. 2 of Rutfors, antenna characteristics, such as isolation, are typically considered. If such characteristics between the balanced and unbalanced antennas are not considered, the two antennas may influence each other and may not work well in combination. The present invention, as recited in claim 1, discloses a composite antenna device that takes into account the characteristics of the balanced and unbalanced antenna such that the two antennas do not influence each other.

Rutfors et al. merely disclose, in Fig. 2, the structure of an antenna device that includes symmetrical balanced antenna 230 and asymmetrical unbalanced antenna 20. Rutfors et al. do not disclose any characteristics used to substitute different unbalanced antennas to be combined with a balanced antenna. In addition, Rutfors et al. do not teach how an asymmetrical unbalanced antenna would be replaced by a symmetrical unbalanced antenna. In order to replace asymmetrical unbalanced antenna 20 with a symmetrical unbalanced antenna (such as metal plate 12 of Colburn et al.), the skilled person typically considers the characteristics of the combination of symmetrical balanced antenna and symmetrical unbalanced antenna. However, Rutfors et al. are silent regarding any characteristics used to replace an asymmetrical unbalanced antenna with a symmetrical unbalanced antenna. Because Rutfors et al. do not teach replacing an asymmetrical unbalanced antenna with a symmetrical unbalanced antenna, Rutfors et al. cannot teach moving feed element to be collinear with feed element 34. Thus, the skilled person would not consider combining the teachings of Rutfors et al. with those at Colburn et al. to produce the subject invention.

Indeed, the only suggestion of a balanced antenna and an unbalanced antenna where the feed points of the respective balanced and unbalanced antennas are collinear comes from Applicant's invention. Applicant respectfully notes that impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art. See MPEP Section 2142. Thus, for the reasons set forth above, claim 1 is patentable over the cited art. Accordingly, allowance of claim 1 is respectfully requested.

Claims 2-4, 7 and 8 include all of the features of claim 1 from which they depend. Accordingly, these claims are also patentable over the cited art.

Claim 5, as amended, includes features neither disclosed nor suggested by the cited art, namely,

> ... the load conductor intersects a straight line which also passes through the first feeding point and which is perpendicular to the ground board;
>
> ... the load conductor of the unbalanced antenna includes a first portion and a second portion,
>
> ... an impedance Z11 of the first portion of the load conductor, a mutual impedance Z12 of the second radiator to the first portion of the load conductor, a mutual impedance Z21 of the first portion of the load conductor to the second radiator, an impedance Z22 of the second radiator, an impedance Z33 of the second portion of the load conductor, a mutual impedance Z34 of the third radiator to the second portion of the load conductor, a mutual impedance Z43 of the second portion of the load conductor to the third radiator, and an impedance Z44 of the third radiator satisfy the relation of

$$\begin{pmatrix} Z11 & Z12 \\ Z21 & Z22 \end{pmatrix} = \begin{pmatrix} Z33 & Z34 \\ Z43 & Z44 \end{pmatrix}.$$

Rutfors et al. is described above. Rutfors et al. do not disclose or suggest that a load conductor of a balanced antenna includes a first portion and a second portion where: a) the impedances of the first and second portions (Z11, Z33), b) the mutual impedances between the first portion of the load conductor and a second radiator of the balanced antenna (Z12, Z21), c) the impedance of the second radiator (Z22), d) mutual impedances between the third radiator of the balanced antenna and a second portion of the load conductor (Z34,

Z43) and e) the impedance of the third radiator (Z44) satisfy a relationship as recited in claim 5. As acknowledged by the Examiner on page 4 of the Office Action, Rutfors et al. fail to explicitly teach the above cited impedances according to the relationship shown in claim 5. Thus, Rutfors, et al. do not include all of the features of claim 5.

Colburn et al. are described above. Colburn et al. do not make up for the deficiencies of Rutfors et al. because Colburn do not disclose or suggest that impedances of first and second portions of a load conductor, mutual impedances between first and second portions (of the load conductor) and second and third radiators (of a balanced antenna), and impedances of the second and third radiators (of the balanced antenna) satisfy a relationship as recited in claim 5.

On page 5 of the Office Action, the Examiner asserts that because Rutfors et al. teach an advantage of using a balanced and unbalanced antenna pair "is that improved matching to the receiver/transmitter is achieved [0008], which will lower the coupling between the two antennas [0007]." Thus, the Examiner argues that it would be obvious to "have matched the impedance of the two antennas of Rutfors in order to have reduced the coupling between the two antennas." Applicant respectfully disagrees. Applicant's relationship recited in claim 5 relates to matching impedances (Z_A) (between segments of the balanced antenna and the unbalanced antenna) on one side of the straight line that intersects the first feeding point to impedances (Z_B) (between segments of the balanced antenna and unbalanced antenna on the other side of the straight line. By matching impedances Z_A on one side of the straight line with impedances Z_B on the other side of the straight line, Applicant's invention allows the balanced and unbalanced antennas to be electrically isolated from each other. (See page 5, line 6 - page 7, line 9 and Fig. 4 of the substitute specification). In contrast, Rutfors et al. teach two antenna elements having balanced and unbalanced feeds, respectively, such that the coupling can be lower than with two antennas both having unbalanced or balanced feeds (paragraph [0007]). Thus, Rutfors et al. do not include all of the features of claim 5 and Colburn et al. do not make up for the deficiencies of Rutfors. Accordingly, allowance of claim 5 is respectfully requested.

Claim 6 includes all of the features of claim 5 from which it depends. Accordingly, claim 6 is also patentable over the cited art.

Claims 9 and 10 have been added. No new matter is introduced herein. Support for claims 9 and 10 can be found, for example, at Figs. 1 and 4. Claims 9 and 10 include all of the features of respective claims 1 and 5 from which they depend and are also patentable over the cited art.

In view of the amendments and arguments set forth above, the above-identified application is in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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